North Carolina Department of Health and Human Services
Employee Safety and Benefits

Safety and Health Program

Indoor Air Quality Survey
Number 04006

Room B1
Lineberry Building
Governor Morehead School for the Blind
Raleigh, North Carolina

On Friday, September 10, 2004, an indoor air quality survey was conducted of Room B1 in the Lineberry Building, Governor Morehead School for the Blind in Raleigh, North Carolina, at the request of Joe Robbins. The assessor was accompanied by Mr. Robbins and Maintenance Director William Glenn.

Observations and Measurements

This is a three-story brick building resting on foundation, with sloped terrazzo-shingled roof. The basement at the west (front) of the building is half below grade, while the south, east, and north sides are at grade level. The ground on the south side was covered with a concrete porch at grade level, and grass-covered earth at the remaining three sides.

The interior of the building was utilized as an education occupancy, with classrooms and supporting rooms on each side of hallways. The majority of wall construction was plaster and/or drywall. The basement – which housed the complaint area (Room B-1) did not have a central HVAC system. Air was treated by self contained units in each room, which provided for heating and cooling but did not introduce fresh air to the room. Because of this condition, the complaint area was also treated as the ventilation area

There is one employee in the complaint area, who reported experiencing allergic reactions attributed to the indoor air.

Temperature and relative humidity readings were taken in the room, using an Extech Instruments Humidity/Temperature Pen. Carbon monoxide measurements were also taken, using a Sensidyne Model 800 hand pump and Sensidyne No. 126SF carbon dioxide detector tube with a range of 100 to 4000 ppm. These measurements compare to the ranges recommended by ASHRAE and OSHA as follows:

Category	**Actual**	**Recommended**	**Result**
Temperature (degrees Fahrenheit)	73°	68° to 76°	Within range
Relative Humidity (percent)	52.5%	20% to 60%	Within range
Carbon Dioxide Amount (ppm)	1600 ppm	0 to 1000 ppm	Above range

Since no outdoor air was introduced to the ventilation system, measurement of linear and cubic feet per minute of air changes served no purpose and were not performed.

The assessor noted the following conditions during visual observation of the complaint area:

> There was evidence of moisture on the south and west walls, which had caused the plaster to delaminate. Each wall was tested for moisture content utilizing a Tramex Moisture Encounter meter, which registered 100% relative moisture in the south and west (exterior) wall for their full lengths, in the north wall on the left side, and on the east wall beside the lefthand door to the hallway. No fungal infestation was observed on these walls, or anywhere else in the room. Mr. Glenn stated that the source of this moisture was seepage through the unsealed concrete floor slab and through the walls beneath grade. The water damage to the walls had been repaired approximately a year prior to the survey, but had returned in that time.

Equipment to reduce the humidity in the room had been installed, but was not operating. The employee stated that she turned it off due to the noise, which interfered with teaching activities.

No other conditions were observed that would decrease the quality of the indoor air of the building.

Conclusions

1. To maintain acceptable indoor air quality, the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) recommends the introduction of at least 15 cubic feet per minute (cfm) of outdoor air per person in offices, and 20 cfm in general office areas, such as classrooms (ASHRAE 62-1989). There is no outdoor air introduced into this room at all, other than around the windows and from the hallway. The high level of carbon dioxide concentrations (1600 ppm) measured is indicative of this condition. The National Institute for Occupational Safety and Health (NIOSH) has determined that concentrations above 1000 ppm can result in headaches, fatigue, and eye and throat irritation, and recommends this as the upper limit for acceptable indoor air quality. (Please note that OSHA's permissible exposure limit for carbon dioxide is 5000 ppm time-weighted over 8 hours of exposure. 1000 ppm is 1/5 that level, so no drastic action – such as building evacuation – is warranted.)

2. Mold and similar fungal infestations grow where there is excessive moisture and food supply. Headaches can be a symptom of fungal exposure. The key to eliminating fungal growths is: (1) clean and disinfect the infested material and (2) identify and eliminate the source of moisture. Although no fungal infestation was observed during the survey, the moisture concentrations measured in the walls suggest that they are potential sources for such growth which should be addressed.

Recommendations

1. The employee should be instructed to open the exterior windows during pleasant days, and to leave the hallway doors open as often as activities allow, in order to increase the amount of outdoor air in the room, and to lower the concentration of carbon dioxide.

2. Immediately clean and repair the moisture damaged areas of the walls. Until the moisture sources are eliminated, repeat this process each time further delaminating occurs. If fungal infestation becomes visible, immediately disinfect the area using the Department's protocol (attached).

3. Instruct the employee to engage the humidity control machinery daily beginning after the last class until just before the first class of the following day.

Respectfully submitted:

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Safety and Health Consultant

September 30, 2004

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Protocol for Cleaning Materials Infested with Mold, Mildew, and Similar Fungal Growths

Types of Materials

Nonporous Materials:	metals, glass, hard plastics, and similar material.
Semi-porous Materials:	wood, plaster, concrete, and similar material
Porous Materials:	carpets/padding, ceiling tiles, insulation, wallboards, and any material which is visibly damaged or has lost structural integrity

Protocol

Preparation (All Materials)

1. Block area from normal employee/client traffic. Full encapsulation (i.e. asbestos operations) is not necessary.

2. Employees performing cleaning don the following protective clothing:

    a. Outer clothing that is easily removed and cleaned, and that covers all areas of the body. This should not be the employee's normal clothing, since it should be removed at the end of the cleaning. (Tyvek type suits can be worn, but are quite hot over extended periods of use).

    b. Rubber gloves with long gauntlets.

    c. Safety goggles to protect against splatter.

    d. If requested by the employee, an NIOSH-approved N95 dust mask (see Respirator Use, below).

3. Shut down the HVAC system serving the area, and secure plastic over the incoming and return air vents using duct tape, so that any spores liberated during cleaning will not be able to circulate through the building.

Cleaning Nonporous and Semiporous Moldy Materials

1. Lightly wet the infested material with a water/detergent solution (soapy water, approximately 4 ounces per gallon). This will prevent mold spores from becoming airborne and entering the breathing zone.

2. Vacuum the material and surrounding non-infested materials with a wet/dry vacuum with HEPA filter.

3. Thoroughly scrub all moldy surfaces, using a non-ammonia soap/detergent and hot water, or commercial cleaner.

4. Vacuum away excess water with a wet/dry vacuum with HEPA filter.

5. Apply a disinfectant (1/4 to ½ cup liquid chlorine bleach to one gallon of water) to the affected areas. Leave disinfectant on area for 6 to 8 hours and allow to dry naturally.

Removing Porous Materials

Note: The cost of cleaning fungal infestations, especially if visible, from porous materials is usually more costly than replacing the material.

1. Lightly wet the infestation with a water/detergent solution (soapy water). This will prevent spores from becoming airborne and entering the breathing zone. Avoid wetting uninfested material that could result in further mold growth.

2. Remove infested material as carefully as possible, minimizing any shaking or similar activities that could dislodge spores.

3. Place removed material in sealable plastic bag.

4. After all infested material has been removed, clean remaining adjacent material by a damp method (such as mopping), using a water/detergent solution, or vacuum with a wet/dry vacuum with HEPA filter.

5. Thoroughly dry remaining material.

6. Dispose of bagged infested material at the local landfill. No special permission or permits are needed.

Completion (all materials)

1. Immediately remove protective clothing and launder or dispose.

2. Immediately remove, thoroughly wash, and disinfect gloves and goggles (follow procedures for cleaning nonporous material)

3. If dust mask is used, disinfect and dispose.

4. Remove plastic from vents and reactivate HVAC, and dispose of plastic.

5. After remaining material is dry, release area to normal use.

Respirator Use

The Department of Health and Human Services, Division of Public Health, Epidemiology Section, recommends the use of respiratory protection when performing mold and similar fungal cleanup. However, adherence to the procedures above will severely minimize the release of fungal spores into the breathing zone, making respirator use unnecessary, and therefore not required.

OSH standard 1910.134(c)(2)(i) allows employers to provide respirators to employees who request them without having to establish a complete respirator policy, if the respirator is (a) a dust mask; (b) not "required", and (c) does not in itself create a hazard. The employer must provide to employees the information contained in Appendix D of 1910.134.

If an employee involved in fungal cleanup activities desires a respirator, then he/she should be provided with a dust mask that: (a) is rated N95; (b) is NIOSH approved; and (c) sports two securing straps as opposed to one. The employee should also be provided a copy of Appendix D of 1910.134 and should sign a statement that this copy was received. After use, the dust mask should be sprayed or dipped in a disinfectant solution and disposed of as normal solid waste (trash).